



Self-Healing Minefield

Advanced Vehicle Maneuver Denial System

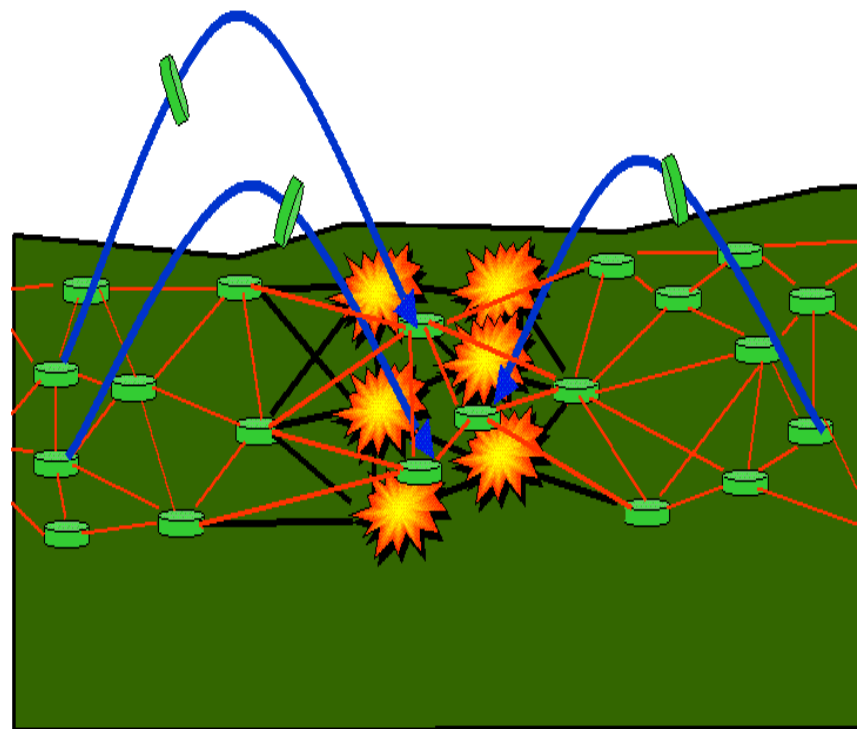
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Self-Healing Minefield



- The Self-Healing Minefield provides a robust obstacle complicating both mounted and dismounted breaching **without the use of antipersonnel landmines**
 - An antipersonnel landmine alternative for the mixed system
- The Self-Healing Minefield Concept
 - Minefield is deployed and begins autonomous monitoring of obstacle integrity
 - Minefield detects a breach attempt via mine-to-mine communication
 - Minefield autonomously determines vulnerability and appropriate response
 - Individual mines respond by reorganizing (moving) to fill breach re-establishing obstacle



Minefield acts like a fluid - cannot sustain a breach



- **DARPA Focus**

- **Enabling Technologies**

- Communications/Networking
 - Healing Algorithms
 - Mobility

- **Identification of technology expansion possibilities**

- **Identification of hurdles to transition**

- Warhead development
 - Countermeasures

- **Future Focus**

- **Army Requirements**

- **System integration**

Programmatic Approach



- **Preliminary analyses**
 - **Assess the robustness against simple breaching**
 - **Assess battlefield utility**
- **Research of enabling technologies**
 - **Mine mobility**
 - **Mine-to-mine communications**
 - **Behaviors**
 - **Miniature warhead**
- **Integrate and test prototype mines**
 - **50+ mine surrogate minefield**
- **Transition to United States Army for development**



- **Challenges**

- Compact self-organizing network scalable to 1000 nodes
- Relative battlefield geolocation to 1 meter without using GPS
- Pathway to low probability of jamming/spoofing network

- **Sandia approach**

- 900MHz COTS chipset
- Acoustic ranging for relative geolocation
- Self-organizing network

- **SAIC/Sensoria Inc. approach**

- Frequency hop spread spectrum
 - 2.4GHz center with 83MHz bandwidth for development
- Acoustic ranging
 - Sub-meter location accuracy
 - Secondary communications channel potential
- Self-organizing network
 - Rapid assembly
 - Dual modem architecture



- **Challenges**

- **Robustness against enemy communication and mobility countermeasures**
 - Systems must degrade gracefully
- **Differentiation between minefield disturbance and breach**
 - Minefield anti-tampering

- **Sandia approach**

- **Distance Distribution – equalizes distances between mines**

- **SAIC approach**

- **Multi-mode**
 - Breach specific
 - Nearest neighbor
 - random
- **Graceful degradation**



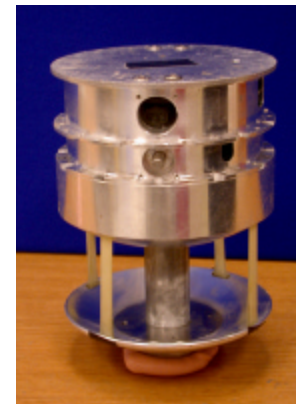
Available
information
decreases

- **Challenges**

- Compact multi-hopping system
- Two sided mobility or single sided mobility with self-righting
- Directional control and repeatability; 10m range/3m height

- **Sandia approach**

- On board fuel/oxidizer
 - ~100 jump capability
- Piston based/ground impact system

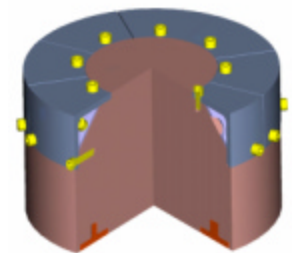


- **SAIC approach**

- 4 end mounted rocket thrusters/100ms action time
- Double sided

- **Foster Miller approach**

- Pyrotechnic initiation expels fly plate
- 8 charges; single sided; self-righting demonstrated



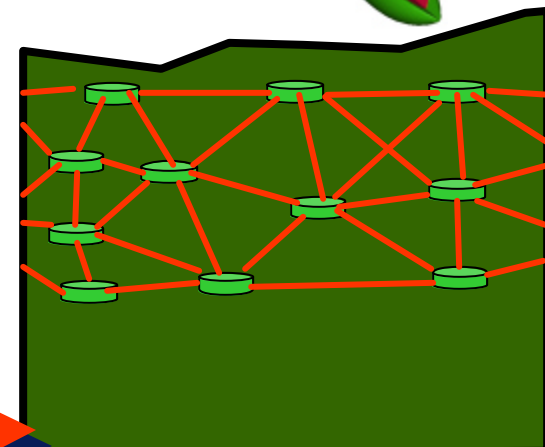
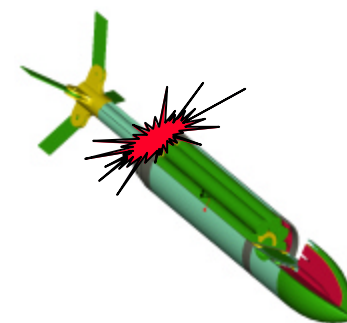
Foster Miller – Flight Tests



Precision Obstacles On-Demand



- Small, mobile (intelligent?) antivehicle mine that can be emplaced using 120 mm mortar
 - Exploits technical successes in Self-Healing Minefield program
 - Miniaturized warhead
 - Compact, self-righting mobility systems
 - Leverages development of novel extended range 120 mm mortar cartridge – XM984



Rocket Assist Extends Range to 11 Km

Conclusions



- **The Self-Healing Minefield assures the Army a robust obstacle to disrupt enemy vehicles**
- **120 mm mortar launched concept permits precision, on-demand deployment of obstacles consistent with future combat doctrine**
- **The Self Healing Minefield and Obstacle on Demand answer the Objective Force call for area denial to enemy vehicles**